45. Figure 2 has been drawn to illustrate Professor Chevalier's warehousing case. A firm with the marginal revenue and marginal cost curves shown in the figure would produce x^* units of output with or without the additional spectrum. As I will now discuss, this finding is the consequence of the unrealistic assumption about the nature of the shift in the marginal cost curve as the firm acquires additional spectrum rights.

46. The actual nature of cost shifts is much different than that portrayed in Professor Chevalier's model. A service provider with access to a given amount of spectrum faces a set of increasingly costly options as it expands its output. Consider a service provider that has access to a fixed amount of spectrum, is seeking to hold its service quality constant, and faces increasing demand for its services. As demand increases, because either the number of users is rising or the amount of service demanded by each consumer is rising, or both, it becomes necessary to utilize additional network equipment in order to serve consumers. A mobile service provider has several options for expanding service on a fixed amount of spectrum.[44] If there is unused spectrum available, one option would be to add carriers, which is relatively inexpensive.[45] However, if the network is already utilizing all of the spectrum available to it, then this option will not be available and the network operator will have to turn other, costlier alternatives. For example, one such alternative could be to add new cell sites, which allows greater spectrum reuse.

47. Stated in economics terms, the need to rely on increasingly expensive options means that a service provider has an increasing marginal cost curve. That is, holding the amount of

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44 *Stone Supplemental Declaration,* ¶¶ 41-48.

45 *Stone Supplemental Declaration*, ¶ 44.

spectrum fixed, the cost of providing an additional unit of service rises as the total number of units of service being provided rises. Moreover, for a network operator such as Verizon Wireless, which is at the point that it has to employ costly options (*e.g.,* macro cell splits and the use of micro cells) to increase capacity, access to additional spectrum shifts its marginal cost curve downward because it allows the firm to avoid costlier options. For example, access to additional spectrum rights can lower a service provider's marginal costs by allowing it to increase the number of carriers rather than increasing the number of cell sites.[46] Figure 3 illustrates how additional spectrum actually shifts a network operator's cost curve. The dashed stair step is the service provider's marginal cost curve when it has access to the smaller amount of spectrum, and the solid stair step is the provider's marginal cost curve when it has access to the larger amount of spectrum.

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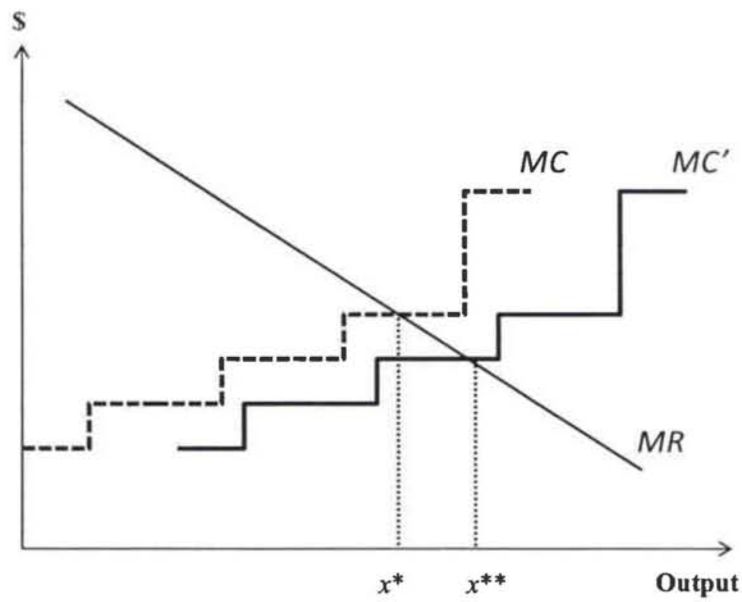
46 Of course, the costs of a spectrum license are a *long-run* incremental cost. An important point is that an optimizing firm will have lower incremental costs when it has access to a broader range of inputs.

Figure 3: Actual Impact of Additional Spectrum



48. Although the differences in the way additional spectrum access shifts the marginal cost curves in Figures 2 and 3 might not seem like much, there is a critical difference. The more realistic shift shown in Figure 3 leads to the intersection of marginal revenue and marginal cost shifting to the right (from x^* to x^{**}), and the firm chooses to produce additional output. In other words, the additional spectrum always leads the service provider to produce more output and, thus, benefits consumers. Professor Chevalier's model assumes this consumer benefit away.

49. Another way to see that Professor Chevalier's model is predicated on inappropriate assumptions about wireless production and cost functions is that she assumes that the increments of capacity made possible by access to additional spectrum get more and more expensive as a firm gains access to additional spectrum. But, in fact, incremental capacity

costs are lower once access to additional spectrum has been obtained; a network operator can add carriers instead of splitting cells, for example.[47]

3. Professor Chevalier's model fails to account for product differentiation.

50. As noted above, Professor Chevalier's model assumes that all service providers offer identical products. In other words, the demand for any one service provider's output is the same as that for any other. The assumption that wireless services are perfectly undifferentiated products and all service providers face the same demand for their services is clearly contradicted by consumer behavior in the wireless marketplace. Consumers are willing to pay more for some services than others, and wireless service providers clearly face different degrees of demand for their services.

51. By assuming these differences away, the model does not recognize that a larger provider may face greater demand for its incremental output than does a smaller provider, with the result that the larger provider can have *greater* incentives to utilize incremental capacity, even if that capacity takes the unrealistic form assumed by Professor Chevalier's model.

4. Professor Chevalier's model ignores the benefits of higher quality that consumers would enjoy.

52. There is an important relationship between capacity utilization and quality that is absent from Professor Chevalier's model but that must be taken into account to conduct a

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[47] Professor Chevalier's model also assumes that the costs of the incremental capacity associated with a given unit of spectrum access are the same for all carriers. However, a network operator with higher demand relative to its spectrum holdings would very likely see its marginal costs fall by a larger amount as the result of additional spectrum access.

proper competitive analysis. Because user demands in a given period of time fluctuate up and down, it is impractical and inefficient to build wireless networks that never become congested. At those times when demand exceeds network capacity, consumers will see quality suffer in terms of blocked or dropped calls and slower data rates. As a network with a given capacity serves more customers and carries more traffic on average, it becomes more likely that the network will be unable to meet the peak demands that it faces. Hence, as the average capacity utilization of the network increases, it becomes more likely that consumers will see quality suffer in terms of blocked or dropped calls and slowed data. Consequently, if a network adds capacity, its quality rises holding quantity fixed. This increase in quality is a consumer benefit that Professor Chevalier's model fails to recognize.

53. This is an important omission because quality is an important determinant of consumer welfare and because quality does not have the inframarginal-units effect that drives Professor Chevalier's results for quantities.[48] In Professor Chevalier's model, a given reduction in *quantity* that raises the market price is differentially attractive to a larger firm because that firm benefits from the price increase over a larger number of units.[49] To the extent that quality improvements are a fixed cost, the logic of Professor Chevalier's model implies that larger firms find it differentially attractive to raise *quality*. Even when there is a

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48 In general, the economics of quality levels can differ significantly from the economics of output levels. For example, although a monopoly producer typically sells too few units of output from an efficiency perspective, there is no theorem in economics stating that a monopolist will necessarily set quality inefficiently low. Indeed, there are well-established conditions under which a firm with market power may set quality inefficiently high. (*See, e.g.,* A. Michael Spence (1975), "Monopoly, Quality, and Regulation," *Bell Journal of Economics* 6(2): 417-429.)

49 *Chevalier Declaration,* Appendix B, at 2.

variable component to the cost of improving quality, a larger firm still might have greater incentives to raise quality than would a smaller one.

5. Professor Chevalier's model is not calibrated to the wireless industry.

54. Professor Chevalier makes no attempt to provide realistic numbers to see if her theory predicts anticompetitive warehousing in the wireless industry, and, indeed, she is careful not to make any claim that it does. However, the T-Mobile filing to which Professor Chevalier's declaration is attached does provide an indirect view of how the model would calibrate to the proposed license assignments.

55. T-Mobile's filing in this proceeding suggests that Professor Chevalier's model would predict that Verizon Wireless does *not* have incentives to engage in anticompetitive warehousing. T-Mobile asserts that "It is likely no coincidence that Verizon Wireless signed this deal while the AT&T/T-Mobile transaction was still pending, so that T-Mobile was unable to compete to purchase this spectrum."[50] In addition to serving as a reminder of how recently T-Mobile adopted the view that increased spectrum concentration is bad, this assertion undermines T-Mobile's claims that a large incumbent engaged in hoarding will be able to outbid a smaller a rival. It also suggests that Professor Chevalier's model would predict that Verizon Wireless is planning to use the spectrum. This is so because Professor Chevalier's model implies that a larger incumbent might not outbid a smaller incumbent when both firms are planning to use the spectrum but that the larger incumbent will always outbid the smaller rival in the hoarding scenario. Hence, T-Mobile's apparent claim that it might

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[50] *T-Mobile Petition* at 15.

have outbid Verizon Wireless in the secondary market indicates that Professor Chevalier's hoarding scenario does not apply.

IV. ATTEMPTS TO GERRYMANDER THE SPECTRUM SCREEN SHOULD BE REJECTED

56. A properly designed transaction screen can play a useful role in providing transparency and in reducing the social and private costs of transaction review by focusing attention on those geographic areas in which additional information would be most useful to making a proper assessment of the public-interest effects of a proposed transaction. However, a screen that focuses on the wrong criteria can harm consumer welfare and efficiency by: (a) supporting an incorrect decision to block a transaction that would otherwise benefit consumers, or (b) triggering unnecessary in-depth review that introduces uncertainty, cost, and delay into the license assignment process.

57. Several participants in this proceeding propose that the Commission should adopt a value-weighted spectrum aggregation screen (*i.e.,* a screen that places greater weight on spectrum licenses in bands that are more financially valuable by some measure).[51] The *RCA Petition* proposes that spectrum below 1 GHz should be weighted more heavily and also

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51 *Cramton Declaration*, ¶¶ 10, 20, 38. *See also T-Mobile Petition*, § IV.B; *RCA Petition*, § VII.B.ii; *Free Press Petition,* § III.A.

Although Sprint-Nextel does not offer specific proposals for a spectrum screen, it recommends that the Commission consider giving various bands of spectrum different weights when using concentration measures to assess competitive effects. (Comments of Sprint Nextel Corporation, *Application of Cellco Partnership d/b/a Verizon Wireless and SpectrumCo LLC For Consent To Assign Licenses and Application of Cellco Partnership d/b/a Verizon Wireless and Cox TMI Wireless, LLC, For Consent To Assign License*, WT Docket 12-4, February 21, 2012 (hereinafter *Sprint Nextel Comments*), §V.)

proposes that bands should be differentially weighted to account for alleged differences in their suitability for an LTE network.[52]

58. Each of the specific proposals is seriously flawed and, thus, cannot serve as a useful tool for a case-by-case analysis. I discuss these proposals and their flaws in the remainder of this section.

A. THE SPECTRUM-SCREEN TRIGGER SHOULD BE RAISED NOT LOWERED.

59. RCA urges the Commission to lower the threshold amount of spectrum that would trigger the screen by: (a) reducing the total amount of spectrum considered in the base amount and (b) changing the triggering percentage. RTG seeks to place a *cap* of 110 MHz on license holdings for spectrum in bands below 2.3GHz,[53] which is less than the threshold amount of the current *screen* in areas where AWS-1 and BRS spectrum is incorporated in the base amount.[54] And Public Knowledge suggests that the Commission should evaluate the competitive effects of the transactions in all areas, whether or not the current screen is triggered – essentially arguing that the spectrum threshold should be lowered to 0 MHz.[55]

60. RCA advocates eliminating two blocks of spectrum from the spectrum screen baseline.[56] The suggestions to lower the screen on this basis fail to take an appropriately

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52 *RCA Petition* at 49.

53 *RTG Petition* at 17-18.

54 The Commission most recently based the spectrum threshold on the sum of cellular, PCS, SMR, and 700 MHz band spectrum, and included AWS-1 and BRS spectrum where available. (*In the Matter of Application of AT&T Inc. and Qualcomm Incorporated for Consent to Assign Licenses and Authorizations*, Order, (hereinafter, *AT&T-Qualcomm Order*), ¶ 39.) Thus the total spectrum used to calculate the screen varies by area and ranges from 280 to 422 MHz.

55 *Public Knowledge Petition,* at 35.

56 *RCA Petition*, §VII.C.

forward-looking view of the industry. Going forward, the spectrum used by other providers to compete with Verizon Wireless may well be broader than the Commission recognizes. For example, new entry may occur through unlicensed spectrum using a very different business model such as a ubiquitous WiFi network. In addition, such a network might have much greater spectrum reuse than a traditional macro-cell network, which means it could have more capacity per MHz than current technologies.

61. RCA also advocates shifting the trigger point in the screen from one-third of the relevant spectrum to one quarter.[57] The Commission's "one-third rule" is implicitly based on the false assumption that no service provider can successfully compete unless it holds licenses to at least as much spectrum as any other service provider. In reality, different service providers pursue different business models; two different providers may have significantly different spectrum needs while both compete successfully; and some service providers may be more successful than others for reasons that are independent of access to spectrum but that give rise to greater demand for spectrum by the more successful service provider. The Commission itself recognized this equal-assignment assumption is incorrect in its first application of the spectrum screen:[58]

> As an initial matter, although 70 MHz represents a little more than one-third of the total bandwidth available for mobile telephony today, we emphasize that a market may contain more than three viable competitors even where one entity controls this amount of spectrum, because many carriers are competing successfully with far lower amounts of bandwidth today.

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57 *RCA Petition*, §VII.C.

58 *Applications of AT&T Wireless Services, Inc. and Cingular Wireless Corporation*, Memorandum Opinion and Order, 19 FCC Rcd 215122 (2004), ¶ 109.

Indeed, a market may contain four or more viable competitors even when two entities each controls more than one-third of the available spectrum. For example, using the Commission's most recent assessment of the amount of spectrum available for CMRS, even if there were two service providers each holding licenses covering 40 percent (169 MHz) of the base spectrum, two additional competitors could each have 42 MHz of spectrum.[59]

62. Lastly, application of a one-third rule is particularly inapt in the present instance because the proposed transactions would have no effect on the number of competitors in any wireless market. The application of a one-quarter trigger would be even more inappropriate.

63. In summary, a move either to reduce the amount of spectrum under the screen or adopt a one-quarter rule would be a step in the wrong direction.

B. Suggestions for a Weighted Screen are Unsound

64. Another set of proposals comprises several attempts to give some spectrum bands greater weight per megahertz than others in the spectrum aggregation screen.

1. Dollar weighting schemes are severely flawed.

65. Some proponents of a new weighting scheme advocate the use of dollar weights (*i.e.*, spectrum that sold at a higher price per megahertz, or that has a higher book value, would be

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[59] The example in the text would apply in areas where both AWS-1 and BRS spectrum are available. (*In the Matter of Application of AT&T Inc. and Qualcomm Incorporated for Consent to Assign Licenses and Authorizations*, Order, (hereinafter, *AT&T-Qualcomm Order*), ¶ 39.) This is true of all the areas in which the proposed license assignments would cause Verizon Wireless's holdings to exceed the threshold. (Description of the Transaction and Public Interest Statement, *Application of Cellco Partnership d/b/a Verizon Wireless and SpectrumCo LLC For Consent To Assign Licenses,* WT Docket No. 12-04, December 16, 2012, Exhibit 5.)

given greater weight.)[60] Although it might have a superficial appearance of being "market-driven" this proposal is based on fundamental misunderstandings of: (a) the objective of competition policy, and (b) how markets operate.

66. The concern of competition policy is consumer welfare. To oversimplify somewhat, consumer welfare depends on outputs, not inputs. Hence, if the dollar values of spectrum license holdings are to be a useful measure of competitive conditions, then it is essential that there be a link between the value of spectrum license holdings and competition in the output market. Proponents of dollar weights have failed to put forth a valid explanation. Professor Cramton has attempted to offer such a theory, but it confuses harm to competitors with harm to competition. Specifically, his explanation of the link between competition and the concentration of "higher-value" (lower frequency) spectrum is the following:[61]

> Unfortunately [Verizon Wireless's] resulting domination in the low-frequency spectrum is not healthy for competition. It means that Verizon can provide better depth of coverage (inside buildings) and better breadth of coverage (in less populated areas) at much lower cost than smaller rivals. Customers value the better coverage and many switch to Verizon.

Despite the claimed focus on the health of competition, the only harm identified here is the harm to *competitors* who would find it difficult to compete with Verizon Wireless if it were able to provide superior services at lower cost due to the characteristics of its spectrum holdings. The relevance and validity of this justification are also called into question by the fact that Verizon Wireless' "low-frequency spectrum" position is not changing in any way as a result of the proposed license assignments.

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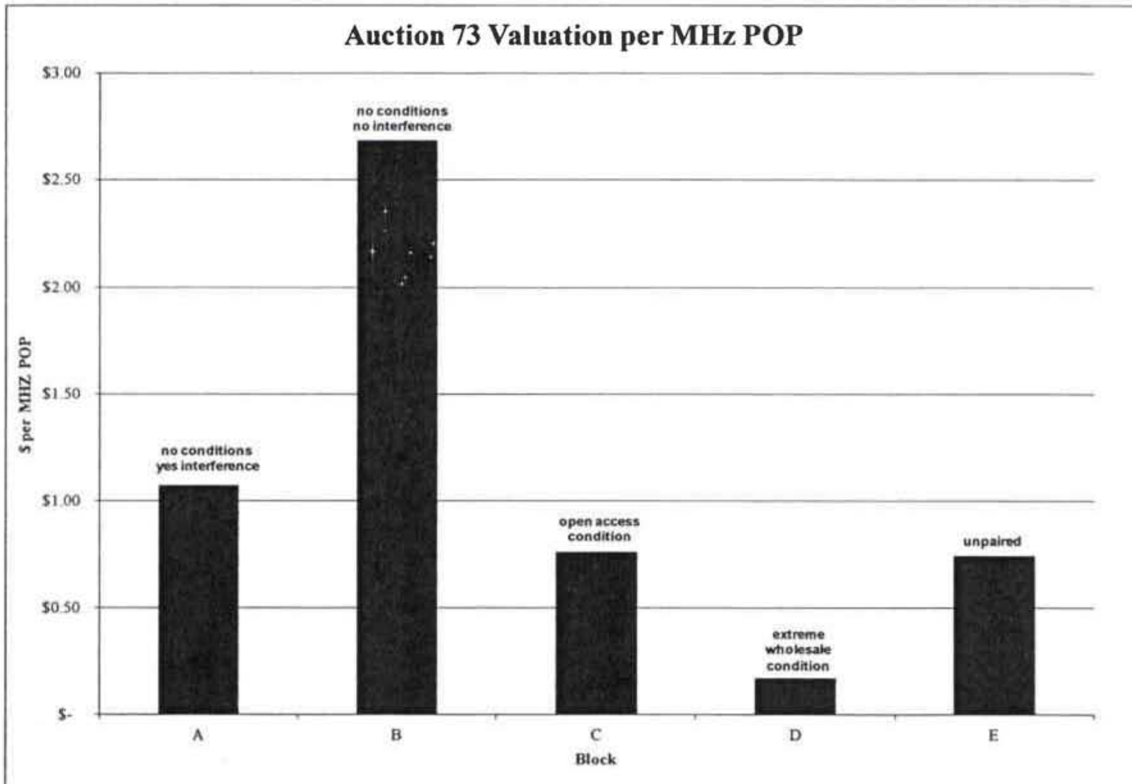
60 *Free Press Petition* at 14-17; *Cramton Declaration,* ¶¶ 30-31.

61 *Cramton Declaration*, ¶ 24.

67. Next consider how proponents of a value-weighted screen misunderstand how markets operate. The per-MHz, per-POP price of a spectrum license reflects a wide variety of factors, including: the geographic scope of the license; the presence of incumbent users; projections of wireless demand and the possibility of future license primary auctions at the time of sale; public policy restrictions placed on the use of the spectrum; and spectrum propagation characteristics. Figure 4, which recreates a chart generated by Anna-Maria Kovacs, shows the wide range of prices paid in Auction 73. Manifestly, differences in propagation characteristics alone cannot explain these price differences.

Figure 4: A Comparison of License Prices



Source: Kovacs (2012), at 6, 7.

68. In order for there to be any logic underlying the use of a dollar-weighted scheme, one must establish that the wide range of factors that drive license prices or book values all are somehow indicative of the resulting competitive conditions. Not only have proponents of a dollar-weighted screen failed to establish any such relationship, proper economic analysis clearly indicates that prices or book values are extremely poor indexes of competitive implications.

69. To see the fundamental misunderstanding of markets inherent in calls for the use of a dollar-weighted screen, consider the following hypothetical example. Suppose *arguendo* that the only driver of the price difference between two licenses was the dollar amount of investment in network infrastructure needed to attain a given network capacity. In such a world: (a) a license that required more capital investment would sell for less, and (b) *the relative prices of two licenses would provide absolutely no information about the relative competitive importance of the two licenses*. Specifically, in a proper analysis of competitive effects, it is a matter of indifference whether a wireless service provider: (a) purchases spectrum for $200 million and has to invest $800 million in network facilities to produce one million units of service, or (b) purchases spectrum for $600 million and has to invest $400 million in network facilities to produce one million units of service. Either path leads to a competitor with the ability to supply one million units of service at a cost of one billion dollars.[62] Yet proponents of a dollar-weighted screen would falsely assert that the supplier

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[62] A full analysis of this example would consider any differences in the service providers' marginal cost curves. Doing so would not change the fundamental conclusion presented in the text that the dollar value of a spectrum license is a poor indicator of its competitive importance. Depending on the nature of network investment, the firm with the lower-value

using the $600-million spectrum is necessarily of three times greater competitive significance than is the supplier using the $200-million spectrum.[63] Proponents of dollar weighting fail to recognize that the production of wireless services requires a mix of inputs.

70. In addition to the failings of dollar-weighted schemes described above, which are common to schemes based on license prices and schemes based on book values, each of these two types of dollar-weighted scheme has unique shortcomings of its own. For example, price-based schemes utilize weights reflecting market conditions at widely varying points in time, making the comparisons inherent in this type of weighting scheme inherently suspect. And book-value-based schemes are subject to differences in the financial accounting judgments of various license holders. As Sprint put it, there are "inherent limitations associated with spectrum book values, which reflect only each carrier's self-assessment of the value of its spectrum holdings in a given period of time."[64] It is difficult to imagine that differences in accounting judgments provide a meaningful index of competitive conditions.

2. Other weighting schemes are also flawed.

71. Some participants in this proceeding advocate other weighting schemes to capture differences that they perceive to exist in the utility of various blocks of spectrum in the

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license could have lower marginal costs over a broad range of output levels than does the firm with the higher-value license.

63 Indeed, as I discuss below, the higher frequencies derided by opponents to the license assignments actually have higher capacity-upsides than do lower frequencies even though the former often sell for less per MHz per-POP.

64 Although it argues for the use of a book-value-based screen, "Sprint recognizes the inherent limitations associated with spectrum book values, which reflect only each carrier's self-assessment of the value of its spectrum holdings in a given period of time." (*Sprint Nextel Comments,* footnote 45.)

provision of mobile telecommunications services, particularly those delivered using LTE.[65] Proponents of weighting schemes based on differences in propagation characteristics overstate the disadvantages of higher frequencies while ignoring their advantages.[66] They also make incorrect statements about which bands are suitable for LTE and ignore the existence of global business ecosystems supporting the development of LTE in a variety of spectrum bands, as well as other 4G technologies.

72. Consider first suggestions to give lower frequencies greater weight. In its recent application of the spectrum screen to the AT&T-Qualcomm transaction, the Commission departed from its long-standing approach of treating all relevant spectrum equally[67] and stated that it looked "more closely" at holdings of spectrum in bands below 1 GHz:[68] The Commission attempted to support its decision by saying that[69]

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65 *See*, e.g., *Free Press Petition* at 12-13; *RCA Petition* at 47-49.

66 These proponents also ignore the fact that the spectrum involved in the proposed license assignments is not in one of the "beachfront" bands and, thus, under their view of the world should be of relatively little consequence for competition.

67 *In the Matter of Applications of Cellco Partnership d/b/a Verizon Wireless and Atlantis Holdings LLC For Consent to Transfer Control of Licenses, Authorizations, and Spectrum Manager and* De Facto *Transfer Leasing Arrangements and Petition for Declaratory Ruling that the Transaction is Consistent with Section 310(b)(4) of the Communications Act*, Memorandum Opinion and Order and Declaratory Ruling, 23 FCC Rcd 17444 (2008) (hereinafter, *Verizon-ALLTEL Order*), ¶ 69 ("Since the Commission first determined to evaluate potential spectrum aggregation of 800 MHz cellular spectrum, 800/900 MHz SMR, and 1.9 GHz broadband PCS spectrum for purposes of competitive review, it has not differentiated among these bands. Nor did we do so last year when we expanded the initial spectrum aggregation screen to include 700 MHz band spectrum. We decline to do so here with respect to the particular 2.5 GHz BRS spectrum or the 1.7/2.1 GHz AWS-1 spectrum that we find suitable for mobile telephony/broadband services.").

68 *AT&T-Qualcomm Order,* ¶ 31.

69 *AT&T-Qualcomm Order,* ¶ 49.

The Commission also asserted that

> Based on the record in this proceeding – and the Commission's analysis in the Fifteenth Annual Mobile Wireless Competition Report – we find that it is prudent to inquire about the potential impact of AT&T's aggregation of spectrum below 1 GHz as part of the Commission's case-by-case analysis.

73. Yet the Commission's claims of the higher cost for build out of higher frequencies made in the AT&T-Qualcomm proceeding are contradicted by the Fifteenth CMRS Competition Report. In that report, the Commission stated:[70]

> Although higher-frequency spectrum does not provide the same level of coverage or in-building penetration as lower-frequency spectrum, in some instances, *higher-frequency spectrum may be just as effective, or more effective, for providing significant capacity, or increasing capacity, within smaller geographic areas.* For instance, AT&T has noted that it cannot be assumed that lower frequency bands will require fewer cells or be more economical to deploy because other factors also affect propagation – including the presence of large buildings in urban areas or other physical impediments. In addition, capacity enhancement technologies such as multiple-input and multiple-output (MIMO) may perform better at higher frequencies. [Emphasis added.]

74. The text highlighted in this quotation is critical. As just discussed in Section IV.B.1, if spectrum license holdings are to be a useful measure of competitive conditions, then it is essential to understand the link between spectrum license holdings and competition in the output market. This quotation reveals that higher frequency may be *more* effective for generating output in dense markets, such as urban areas, in which the demand for mobile

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> Post-transaction, AT&T would hold a significant proportion of the available spectrum suitable for the provision of mobile voice or broadband services, particularly below 1 GHz spectrum, that has technical attributes important for other competitors to meaningfully expand their provision of mobile broadband services or for new entrants to have a potentially significant impact on competition. (*AT&T-Qualcomm Order*, ¶ 51.)

70 Fifteenth Report, *In the Matter of Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993 Annual Report and Analysis of Competitive Market Conditions With Respect to Mobile Wireless, Including Commercial Mobile Services*, WT Docket No. 10-133, rel. June 27, 2011.

telecommunications services and, thus, the demand for spectrum allocated to mobile telecommunications services, is the greatest. Stated another way, a wireless service provider facing a rival with 20 MHz of high-frequency spectrum could well face a stronger competitive constraint than if it faced a rival with 20 MHz of lower-frequency spectrum because the former could have a greater ability to construct a higher-capacity, cost-effective network. Hence, proposals to give less weight to higher frequencies may be exactly backward.

75. The finding that high-frequency spectrum can be very effective accords with the following statement by Dr. John Saw, Chief Technology Officer of Clearwire. Clearwire has large holdings of spectrum licenses at 2.5 GHz. Dr. Saw has stated that[71]

> Our extensive trial has clearly shown that our 'LTE Advanced-ready' network design, which leverages our deep spectrum with wide channels, can achieve far greater speeds and capacity than any other network that exists today. Clearwire is the only carrier with the unencumbered spectrum portfolio required to achieve this level of speed and capacity in the United States.

76. Next, consider the claims that Verizon Wireless has the ability to control wireless innovation ecosystems and, thus, its holdings drive which spectrum is valuable.[72] These claims implicitly and incorrectly assert that wireless ecosystems stop at national borders. They do not. Wireless economic ecosystems are global in scope. For example, Clearwire's Chief Technology Officer has stated that "the 2.5 GHz spectrum band in which we operate is widely allocated worldwide for 4G deployments, enabling a potentially robust, cost-effective and global ecosystem that could serve billions of devices."[73] He also stated that "We

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71 Clearwire, "Announcing the Future of LTE," *available at* http://www.clearwire.com/company/featured-story, *site visited* February 26, 2012.

72 *RCA Petition*, §VIII.C.

73 Clearwire, "Announcing the Future of LTE," *available at* http://www.clearwire.com/company/featured-story, *site visited* February 26, 2012.

anticipate that the economies of scale derived from this global ecosystem will act as a catalyst for the development of thousands of low-cost devices and applications."[74]

77. In summary, the proposed changes to the spectrum aggregation screen based on "beachfront-property" claims will not improve the quality of the Commission's review of license assignments. Instead, designing and applying a spectrum-weighting scheme would add needless delay and complexity to the screen and Commission review. These proposed changes should be rejected.

V. CONCLUSION

78. I have analyzed the central economic arguments made by opponents to the proposed license assignments. For the reasons described above, the Commission should reject these arguments.

I declare, under penalty of perjury, that the foregoing is true and correct.

Michael L. Katz

March 1, 2012

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[74] *Id.*

VI. APPENDIX: QUALIFICATIONS

79. I hold the Sarin Chair in Strategy and Leadership at the University of California at Berkeley. I hold a joint appointment in the Haas School of Business Administration and in the Department of Economics. At the Haas School, I serve as the Director of the Institute for Business Innovation. I have also served on the faculty of the Department of Economics at Princeton University and the Stern School of Business at New York University. I received my A.B. from Harvard University *summa cum laude* and my doctorate from Oxford University. Both degrees are in Economics.

80. I specialize in the economics of industrial organization, which includes the study of antitrust and regulatory policies. I regularly teach courses on microeconomics and business strategy. I am the co-author of a microeconomics textbook, and I have published numerous articles in academic journals and books. I have written academic articles on issues regarding the economics of network industries, two-sided markets, systems markets, and antitrust enforcement. My curriculum vitae is attached to this report as Tab 1. It lists all publications that I have authored or co-authored, with the exception of a few letters to the editor on telecommunications and antitrust policy. I am a co-editor of the *Journal of Economics and Management Strategy* and serve on the editorial boards of *Information Economics and Policy* and the *Journal of Industrial Economics*.

81. In addition to my academic experience, I have consulted on the application of economic analysis to issues of antitrust and regulatory policy. I have served as a consultant to both the U.S. Department of Justice and the Federal Communications Commission on issues of antitrust and regulatory policy. I have served as an expert witness before state and federal

courts. I have also provided expert testimony before a state regulatory commission and the U.S. Congress.

82. From January 1994 through January 1996, I served as the Chief Economist of the Federal Communications Commission. I participated in the formulation and analysis of policies toward all industries under Commission jurisdiction. As Chief Economist, I oversaw both qualitative and quantitative policy analyses.

83. From September 2001 through January 2003, I served as the Deputy Assistant Attorney General for Economic Analysis at the U.S. Department of Justice. I directed a staff of approximately fifty economists conducting analyses of economic issues arising in both merger and non-merger enforcement. My title as Deputy Assistant Attorney General notwithstanding, I am not an attorney.

84. I have also served on advisory panels related to spectrum policy issues. I served on the Committee on Wireless Technology Prospects and Policy Options for the Computer Science and Telecommunications Board of the National Research Council of the National Academies. This Committee examined innovation in wireless communications technologies and its implications for public policy toward spectrum allocation and assignment.

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Exhibit 5

Other Holders of In-Screen Spectrum

OTHER HOLDERS OF IN-SCREEN SPECTRUM
IN COUNTIES/PARISHES WHERE FCC SPECTRUM SCREEN IS TRIGGERED[1]

Alabama 4 – Bibb (CMA310) Spectrum Screen Triggered in 2 of 6 Counties (Bibb & Chilton) Post-Transactions: VZW Would Exceed Screen by 2 MHz	
County	**Other "In-Screen" Spectrum Holders**
Bibb	**Total: 9** AT&T; Barat Wireless; C Spire; CenturyTel; Clearwire; DISH; SouthernLINC; Sprint; T-Mobile
Chilton	**Total: 9** AT&T; Barat Wireless; C Spire; CenturyTel; Clearwire; DISH; SouthernLINC; Sprint; T-Mobile

Alabama 8 – Lee (CMA314) Spectrum Screen Triggered in 1 of 5 counties (Henry) Post-Transactions: VZW Would Exceed Screen by 2 MHz	
County	**Other "In-Screen" Spectrum Holders**
Henry	**Total: 9** AT&T; Barat Wireless; CenturyTel; Clearwire; DISH; Public Service Wireless; SouthernLINC; Sprint; T-Mobile

Arkansas 11 – Hempstead (CMA334) Spectrum Screen Triggered in 1 of 4 counties (Hempstead) Post-Transactions: VZW Would Exceed Screen by 12 MHz	
County	**Other "In-Screen" Spectrum Holders**
Hempstead	**Total: 7** AT&T; Barat Wireless; CenturyTel; Clearwire; DISH; Sprint; T-Mobile

[1] The term "In-Screen Spectrum" refers to spectrum in the following bands: Lower and Upper 700 MHz (80 MHz); Cellular (50 MHz); SMR (26.5 MHz); AWS-1 (90 MHz); Broadband PCS (120 MHz); and Broadband Radio Service (55.5 MHz). The data in this attachment is generally derived from Exhibit 7 to the Public Interest Statement filed in connection with the Verizon Wireless/SpectrumCo transaction (Lead Application File No. 0004993617), and assumes consummation of (1) the assignment of licenses from affiliates of Leap Wireless to Verizon Wireless, with respect to which applications are currently pending with the FCC (*see* FCC Public Notice, DA 11-2018 (rel. Dec. 14, 2011)), and (2) the transfer of control of licenses held by Redwood Wireless to AT&T, to which the Commission recently consented (*see* FCC Public Notice, Report No. 7478 (rel. Jan. 25, 2012). References to DISH refer to spectrum held by its wholly-owned subsidiary Manifest Wireless LLC.

Louisiana 2 – Morehouse (CMA455) Spectrum Screen Triggered in 2 of 7 Parishes (Madison & Tensas) Post-Transactions: VZW Would Exceed Screen by 4 MHz	
Parish	**Other "In-Screen" Spectrum Holders**
Madison	**Total: 9** AT&T; C Spire; CenturyTel; Clearwire; Command Connect; DISH; Sprint; T-Mobile; U.S. Cellular
Tensas	**Total: 9** AT&T; C Spire; CenturyTel; Clearwire; Command Connect; DISH; Sprint; T-Mobile; U.S. Cellular

Grand Rapids, Michigan (CMA064) Spectrum Screen Triggered in Both Counties (Kent & Ottawa) Post-Transactions: VZW Would Exceed Screen by 4 MHz	
County	**Other "In-Screen" Spectrum Holders**
Kent	**Total: 6** AT&T; Clearwire; DISH; MetroPCS; Sprint; T-Mobile
Ottawa	**Total: 6** AT&T; Clearwire; DISH; MetroPCS; Sprint; T-Mobile

Lansing-East Lansing, MI (CMA078) Spectrum Screen Triggered in All Four Counties (Clinton, Eaton, Ingham & Ionia) Post-Transactions: VZW Would Exceed Screen by 9 MHz	
County	**Other "In-Screen" Spectrum Holders**
Clinton	**Total: 6** AT&T; Clearwire; DISH; MetroPCS; Sprint; T-Mobile
Eaton	**Total: 6** AT&T; Clearwire; DISH; MetroPCS; Sprint; T-Mobile
Ingham	**Total: 6** AT&T; Clearwire; DISH; MetroPCS; Sprint; T-Mobile
Ionia	**Total: 6** AT&T; Clearwire; DISH; MetroPCS; Sprint; T-Mobile

Saginaw-Bay City-Midland, MI (CMA094) Spectrum Screen Triggered in All Three Counties (Bay, Midland & Saginaw) Post-Transactions: VZW Would Exceed Screen by 9 MHz	
County	**Other "In-Screen" Spectrum Holders**
Bay	**Total: 7** Agri-Valley; AT&T; DISH; MetroPCS; Speednet; Sprint; T-Mobile
Midland	**Total: 7** Agri-Valley; AT&T; DISH; MetroPCS; Speednet; Sprint; T-Mobile
Saginaw	**Total: 7** Agri-Valley; AT&T; DISH; MetroPCS; Speednet; Sprint; T-Mobile

Minneapolis-St. Paul, MN-WI (CMA015) Spectrum Screen Triggered in 6 of 10 Counties (Carver, Chisago, Dakota, Scott, Wright, MN & St. Croix, WI) Post-Transactions: VZW Would Exceed Screen by 19 MHz	
County	**Other "In-Screen" Spectrum Holders**
Carver	**Total: 7** AT&T; Carroll Wireless; Clearwire; Cook Inlet; DISH; Sprint; T-Mobile
Chisago	**Total: 7** AT&T; Carroll Wireless; Clearwire; Cook Inlet; DISH; Sprint; T-Mobile
Dakota	**Total: 7** AT&T; Carroll Wireless; Clearwire; Cook Inlet; DISH; Sprint; T-Mobile
Scott	**Total: 7** AT&T; Carroll Wireless; Clearwire; Cook Inlet; DISH; Sprint; T-Mobile
Wright	**Total: 7** AT&T; Carroll Wireless; Clearwire; Cook Inlet; DISH; Sprint; T-Mobile
St. Croix	**Total: 8** AT&T; Carroll Wireless; Clearwire; Cook Inlet; DISH; Sprint; T-Mobile; West Wisconsin Telephone